

*Abralia fasciolata*, a New Species of Enoploteuthid Squid  
from the Western Indian Ocean  
(Cephalopoda: Oegopsida)

by

Kotaro TSUCHIYA

Tokyo University of Fisheries, Tokyo

**Abstract** The Indian Ocean species, *Abralia fasciolata* n. sp. is described. The present new species is characterized by having a fasciolate photophore arrangement on the mantle and head, more than five monotypic subocular photophores, hectocotylization on the right ventral arm with bilobate ventral crest, and DDDD-type of buccal connectives. The present new species is closely related to another Indian Ocean species, *Enigmoteuthis dubia* (ADAM, 1960) and *Abralia marisarabica* OKUTANI, 1983. The genus *Enigmoteuthis* ADAM, 1973 is merged to the subgenus of the genus *Abralia* GRAY, 1849, and the subgenus *Arabralia* NESIS, 1987 is synonymized with *Enigmoteuthis*.

Among a hundred species of oegopsid squids from the Indian Ocean, seven enoploteuthids of the genus *Abralia* GRAY, 1846 have been recorded from the Indian Ocean (SILAS, 1968; OKUTANI, 1983; SILAS *et al.*, 1985; NESIS, 1986; OKUTANI & TSUKADA, 1988). They are,

*Abralia armata* (QUOY et GAIMARD, 1832),

*Abralia andamanica* GOODRICH, 1896,

*Abralia steindachneri* WEINDL, 1912,

*Abralia renschi* GRIMPE, 1931,

*Abralia spaercki* GRIMPE, 1931,

*Abralia lucens* VOSS, 1963, and

*Abralia marisarabica* OKUTANI, 1983.

In the cephalopod collection of the U. S. National Museum of Natural History, another undescribed species of the genus *Abralia* from the Indian Ocean was discovered. It is a new addition to the Indian Ocean cephalopod fauna.

The measurements and terminologies mostly follow ROPER and VOSS (1983).

I send my gratitude to Dr. Clyde F. E. ROPER and Mr. Michael J. SWEENEY, U. S. National Museum of Natural History, Washington, D. C., for their kindest permission to study the materials under their care. I am grateful to Dr. Takashi OKUTANI, Professor of Tokyo University of Fisheries, for his criticism and advice during the present study. I also send my thanks to Dr. Tsunemi KUBODERA, National Science Museum, Tokyo, for the loan of comparative materials.

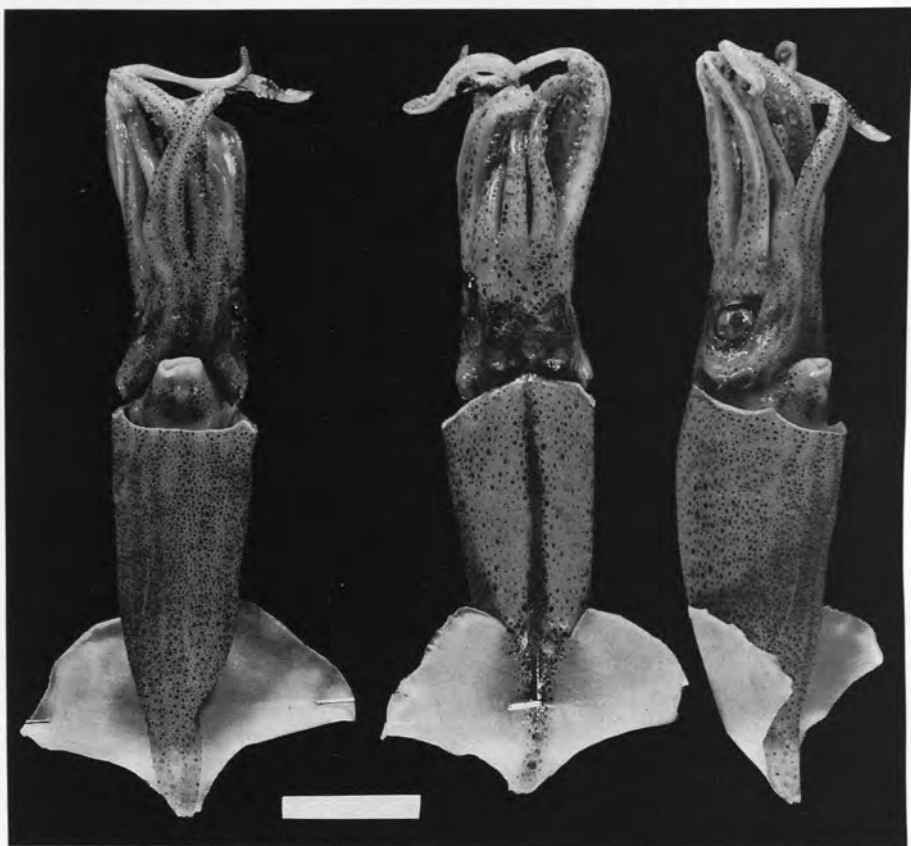


Fig. 1. *Abralia fasciolata* n. sp. — Three views of the paratype No. 7. Scale bar 10 mm.

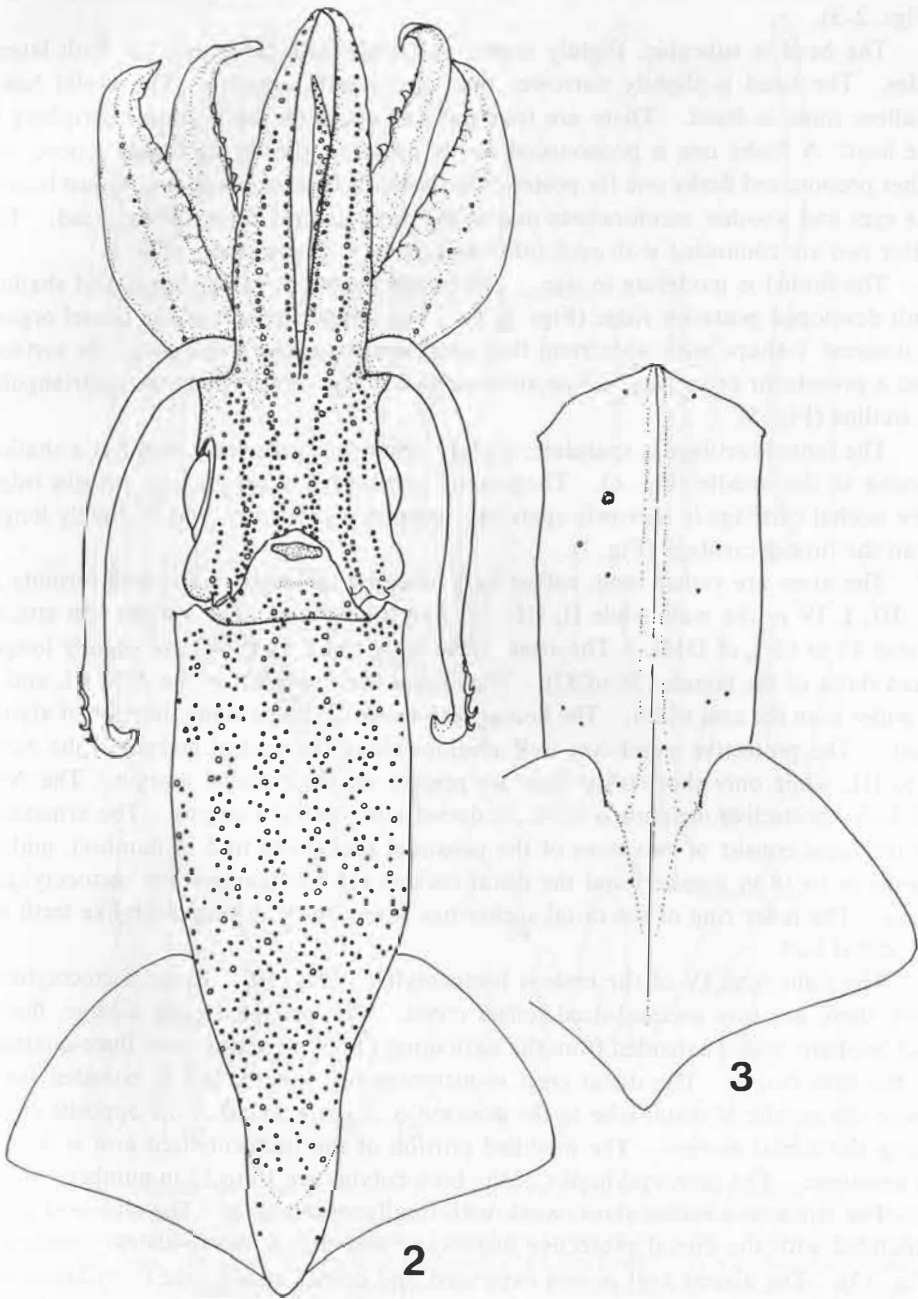
*Abralia fasciolata* n. sp.

*Materials examined.* 46 specimens, 21.8 to 37.7 mm ML, from 11°14'06"N, 47°38'12"E, 15 February 1986 by the R/V *Beinta*, surface small seine.

*Diagnosis.* Moderate-sized *Abralia* characterized by having fasciolate photophore arrangement on the mantle and head, more than five monotypic subocular photophores, hectocotylization on the right ventral arm with bilobate ventral crest, and DDDD-type of buccal connectives.

*Description.* The body is moderate in size for the genus. The mantle is rather thin, weakly muscular and conico-cylindrical in shape, terminating posteriorly to a blunt end of a short gelatinous tail. The mantle width is about 30 to 45% of ML (Figs. 1-2).

The fins are rhombic in outline with small free lobes on both anterior margins. The fin length is about 50 to 55% of ML, while its width attains about 75 to 85% of



Figs. 2-3. *Abralia fasciolata* n. sp. — 2. Ventral view of the paratype No. 7 (female, 33.9 mm DML). 3. Dorsal view of mantle of the same.

ML. The maximum width is situated slightly anterior to the middle of its length (Figs. 2-3).

The head is subcubic, slightly tapers anteriorly with large eyes on both lateral sides. The head is slightly narrower than the mantle opening. The eyelid has a shallow sinus in front. There are four pairs of crests on the posterior periphery of the head: A fleshy one is pronounced at the posterior rim of the funnel groove, another pronounced fleshy one far posterior to the tentacle, a membranous one just behind the eyes and another membranous one at the dorso-lateral corner of the head. The latter two are connected with each other and forms C-shaped ridge (Fig. 4).

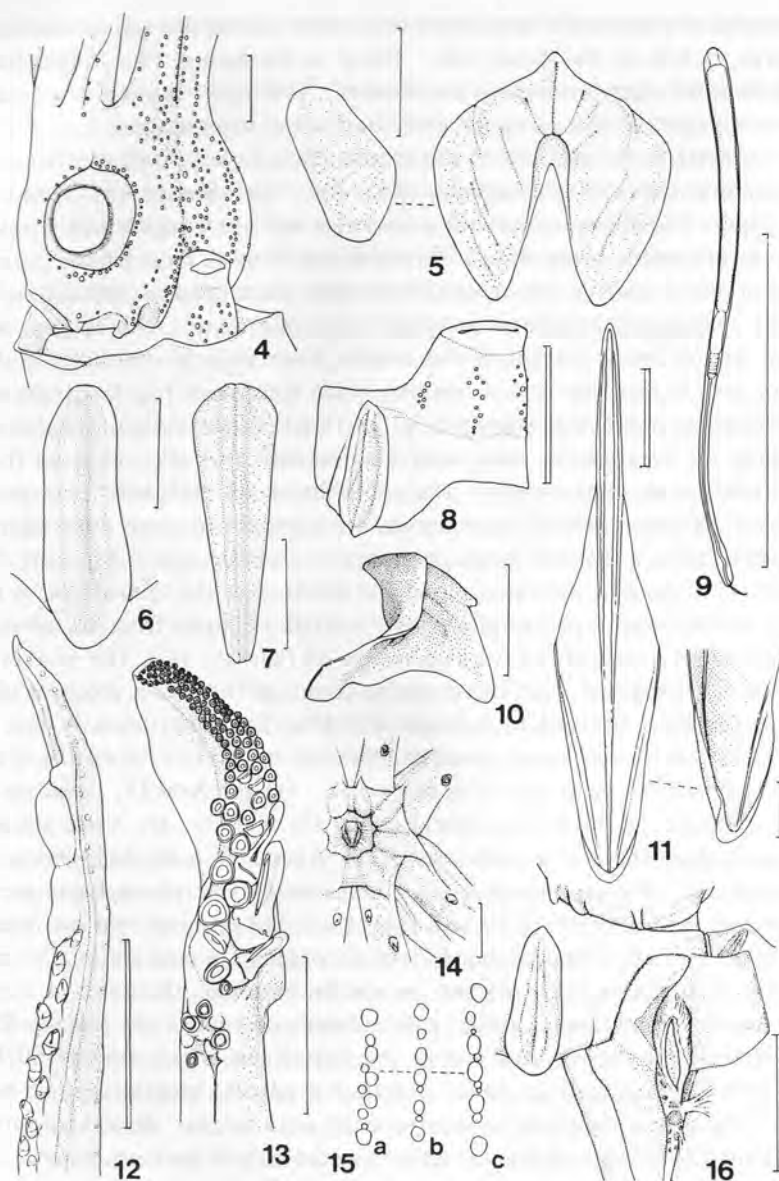
The funnel is moderate in size. The funnel groove is rather broad and shallow with developed posterior ridge (Figs. 4, 8). The dorsal element of the funnel organs is inverted V-shape with wide rami that carry many incised wrinkles on the surface, and a prominent protrusion at the anterior end. The ventral pads are subtriangular in outline (Fig. 5).

The funnel cartilage is spatulate, slightly expanded posteriorly, and has a shallow groove in the middle (Fig. 6). The mantle cartilage is a simple and straight ridge. The nuchal cartilage is narrowly spatulate, expanded anteriorly, and is slightly longer than the funnel cartilage (Fig. 7).

The arms are rather long, robust and subequal in length. The arm formula is II, III, I, IV in the male while II, III=IV, I in the female. The longest arm attains about 45 to 65% of DML. The arms of the male (ALI 45 to 65) are slightly longer than those of the female (38 to 53). The aboral keel is widest in the Arm III, and it is wider than the arm width. The honeycomb tissue develops along the base of aboral keel. The protective membrane well develops along the ventral margin of the Arms I to III, while only short trabeculae are present on their dorsal margin. The Arm IV lacks protective membrane on both dorsal and ventral margins. The armatures of the arms consist of two rows of the proximal suckers (0 to 5 in number), middle hooks (6 to 18 in number) and the distal suckers (15 to 46 except for hectocotylized arm). The inner ring of the distal sucker has seven or eight long comb-like teeth on the distal half.

The right Arm IV of the male is hectocotylized (Fig. 12). In the hectocotylized arm, there are two unequal-sized, offset crests. The proximal crest is large, fleshy and bilobate, and is extended from the sixth dorsal hook to about distal three-quarters of the arm length. The distal crest is membranous, lunate, and is extended from about the middle of distal lobe to the position of slightly distad of the opposite crest, along the dorsal margin. The modified portion of the hectocotylized arm is devoid of armature. The proximal hooks of the hectocotylus are 10 to 12 in number.

The tentacle is rather short, weak with totally naked stalk. The club is slightly expanded with the dorsal protective membrane and lunate ventro-aboral membrane (Fig. 13). The aboral keel is well expanded and comes appearance from about the middle of the manus. The carpal group consists of four suckers and four round pads arranged in a circle together with other two or three smaller polygonal pads. The



Figs. 4-16. *Abralia fasciolata* n. sp. — 4. Lateral view of the head of the paratype No. 7. 5. Funnel organ of the paratype No. 4. 6. Left funnel cartilage of the same. 7. Nuchal cartilage of the same. 8. Ventrolateral view of the funnel of the same. 9. Spermatophore of the same. 10. Lower jaw plate of the female (33.5 mm DML). 11. Gladius of the same. 12. Hectocotylized arm of the paratype No. 4. 13. Left tentacular club of the paratype No. 9. 14. Oral view of the buccal region of the paratype No. 7. 15. Subocular photophores, a. paratype No. 4; b. paratype No. 8; c. paratype No. 6. 16. Spermatophore reservoir receptacle of the paratype No. 8. (Scale: single bar 2 mm; double bar 5 mm).

manus consists of a series of two to four hooks on the ventral row and two series of three to five large suckers on the dorsal side. Distal to the manus, four longitudinal rows of about 90 small dactylus suckers are present. The inner ring of the manus sucker had about ten square teeth along the distal half of the inner margin.

The ventral outer surfaces of the mantle, funnel, head and the Arms III and IV are ornamented with photophores (Fig. 2). The photophores consist of two different types: The large organs with gray center and small organs with black center. On the ventral mantle, about 450 to 700 small and 45 to 60 large organs are arranged in six longitudinal rows on the anterior half, while these rows are diffused in the posterior half to make photophores arranged uniformly there. Photophores arranged along the anteroventral margin of the mantle break only at the midventral photophore-less strip. On the dorsal mantle, there are about 20 small photophores arranged sparsely and symmetrically (Fig. 3). On the ventral funnel, about 35 to 40 photophores are arranged in four short longitudinal rows (Fig. 8). On the funnel retractor muscle, there are nine or ten photophores on each side. On the ventral head, about 200 small and 15 large organs are arranged in seven longitudinal rows: The midventral row is a sparse single row, appears from the anterior border of the funnel groove, bifurcated at the anterior end and continue to the ventral row on the Arm IV. The inner (ventral) pair of photophore rows also appears from the funnel groove and is continuous anteriorly to the median row on the Arm IV. The median pair of photophore rows appears from the posterior corner of the funnel groove and is continuous to the outer (dorsal) row on the Arm IV. The outer (dorsal) pair of photophore rows consists of a single row that breaks at the level of the middle of the orbit and fused to the rows of median pair anteriorly. On the Arm IV, there are 80 photophores arranged in three longitudinal rows. On the Arm III, there are about 20 photophores along the aboral surface of arm. About 30 to 40 photophores are bordering the orbit. Five to eleven small, orange monotypic photophores are present on the ventral periphery of the eyeball (Fig. 15). The terminal two are hemispheric and the largest of all. The intermediate three organs are medium in size, and oval in outline. The other ones, if present, are smaller than the others.

The buccal membrane is thick, pale colored, and has eight lappets (Fig. 14). The buccal connectives are attached to the dorsal side of all arms (DDDD-type).

The lower jaw plate (Fig. 10) is darkened gradually without spot or hook-like staining. The rostral length is two-thirds of the wing length. Height is shorter than the base length. Hood is slightly shorter than the half of the crest length. The jaw angle is about  $100^{\circ}$ . The jaw edge is concave anteriorly while convex near the jaw angle. The hood lies close to the crest, and it is moderately curved. There is a notch near the crest on the lateral wall. The posterior edge of the hood is entire without incision. There is a low wing fold which is round, broad and evenly thickened. The shoulder forms a distinct tooth. The shoulder groove is broad and shallow. A darkened area under the jaw angle forms a broad and blunt angle. The jaw edge is blunt and thickened. The crest is broad and thin. The lateral wall has a ridge

running from the jaw edge to the point at about halfway between the crest and the free corner.

The spermatophore (Fig. 9) is about 3 to 3.5 mm in length. The sperm mass is about 50% of its length, not reaching to the aboral tip. The cement body is short, cylindrical with cylindrical oral connective complex with some constrictions.

The seminal receptacle (Fig. 16) is swollen, purse-shaped pocket with longitudinal slit, which is extend from slightly anterior to the stellate ganglion to the middle of the collar. It is situated at both lateral sides of nuchal cartilage on the inner side of the collar, but occasionally it exceeds over the posterior margin of the collar. On the outer surface of the pocket, there are many wrinkles stained in purple, while other portions of the inner collar are avoid of chromatophore.

The gladius (Fig. 11) is robust and penniform. The vane is very thin and attains about posterior one-third of the pen length. The gladius width is about 20% of its length. The widest part is situated at about anterior 60% of its length. The anterior margin of the vane is slightly concave. The lateral margin of vane has a weak angle. The endocone has a distinctly curved, keel-like angle at the posterior corner. The angle in cross section of the gladius is about  $110^{\circ}$  to  $120^{\circ}$  in the median portion.

*Type locality.*  $11^{\circ}14'06''\text{N}$ ,  $47^{\circ}38'12''\text{E}$ , R/V *Beinta* cruise no. 8, St. 1, 15 Feb. 1986.

*Type depository.* U. S. National Museum of Natural History (holotype, USNM 817660 and 41 paratypes, USNM 817759) and National Science Museum, Tokyo (4 paratypes, NSMT-MO 67140 to 67143) (Table 1).

*Distribution.* Gulf of Aden.

*Measurements.* See Table 1.

*Remarks.* The present new species is characterized by having fasciolate photophore arrangement on the mantle and head, bilobate crest on the hectocotylus, more than five monotypic subocular photophores, and DDDD-type of buccal connectives. The present new species is placed in the genus *Abralia* by the characters of absence of terminal large photophores on the Arm IV, presence of a single row of hooks and two rows of large suckers on the club, and thick and pale buccal membrane. Nevertheless, only the character of the buccal connectives (DDDD) does not match to that of the most of other members in the genus *Abralia* (DDVD).

An Indian Ocean species, *Abralia marisarabica* OKUTANI, 1983 most resembles the present new species in the characters of mantle texture, the photophore arrangements on the ventral mantle, funnel and head, morphology of the hectocotylus, shape and number of subocular photophores, and buccal connectives (DDDD). The semilunar ventral membrane is present on the club while it was not mentioned in the original description. The club of *A. marisarabica* is also similar to that of the present new species including the number of club hooks.

However, the present new species is easily separable from *A. marisarabica* by larger number of photophores on the mantle (ca. 500 to 750 versus 350) and head

Table 1. Measurements, indices and counts of *Abralia fasciolata* n. sp.

	Paratype 4 NSMT-Mo 67140		Holotype USNM 817660		Paratype 1 USNM 817759		Paratype 2 USNM 817759		Paratype 3 USNM 817759	
Sex	male		male		male		male		male	
DML	27.4 mm		24.3 mm		24.0 mm		23.3 mm		21.8 mm	
MWI	36.9		28.3		44.2		40.8		42.7	
FLI	52.6		51.0		50.8		52.4		47.7	
FWI	77.7		79.4		85.8		83.3		85.3	
HWI	27.4		32.9		27.5		30.9		27.5	
ALI										
I	51.1	49.6	45.3	46.5	47.9	46.7	51.5	48.1	51.8	52.8
II	59.1	57.7	55.6	53.5	47.1+	54.2+	54.9	60.9	65.6	56.0
III	57.7	52.9	54.3	47.3+	50.8	50.0	57.9	56.7	54.1	58.3
IV	46.0	44.9	53.1	46.5	46.7	48.3	46.4	51.5	52.8	53.2
HcLI	27.0	—	29.2	—	25.0	—	34.3	—	26.1	—
TLI	91.9	94.5	100.8	92.2	125.0	131.0	131.0	124.9	123.4	123.9
CLI	19.3	20.0	21.0	19.0	21.7	22.5	20.6	21.0	22.9	23.9
ASC & (AHC)										
I	2(10) 36	2(11) 34	3( 9) 35	3(10) 41	4( 9) 34	3(10) 28	4( 8) 36	5( 6) 28	1(11) 37	1(10) 36
II	2(13) 33	2(11) 31	2(15) 31	3(13) 36	3(12) 12+	3(12) 32+	2(7+) 32+	2( 8) 37	2(12) 34	2(12) 33
III	3(11) 21	2(12) 28	1(14) 28	2(14) 34	1(13) 28	1(13) 26	2( 13) 27	2(12) 28	1(13) 30	1(12) 26
IV	1(10) 0	0(14) 21	1(12) 0	2(13) 19	1(11) 0	1(11) 23	1( 11) 0	1(12) 22	0(11) 0	0(13) 18



		Paratype 5 USNM 817759		Paratype 6 USNM 817759		Paratype 7 USNM 817759		Paratype 8 USNM 817759		Paratype 9 NSMT-Mo 67141	
Sex		female		female		female		female		female	
DML		36.4 mm		35.0 mm		33.9 mm		32.9 mm		31.4 mm	
MWI		33.2		37.4		33.9		38.9		31.8	
FLI		52.7		55.1		51.9		56.5		48.4	
FWI		79.4		76.0		80.5		79.9		75.8	
HWI		28.3		31.4		28.0		25.2		29.6	
ALI											
	I	40.1	36.5	41.1	40.6	41.3	41.3	42.6	41.6	38.2	41.4
	II	44.0	43.7	52.6	52.6	47.2	50.7	42.6	45.6	48.4	45.2
	III	42.0	42.9	49.1	45.7	41.3	37.8	47.1	44.1	43.0	51.0
	IV	40.9	43.4	47.7	48.6	41.9	42.8	48.0	46.2	43.6	44.6
HcLI		—		—		—		—		—	
TLI		70.9	70.6	104.9	104.6	82.0	73.7	82.0	73.7	93.3	82.2
CLI		17.3	16.5	21.1	19.7	17.7	18.3	16.7	17.0	20.1	19.1
ASC											
	I	1(15) 43	1(12) 42	1(14) 43	0(15) 46	0(14) 32	0(14) 34	2(10) 32	2(10) 34+	0(14) 31	0(16) 31
	II	1(15) 44	1(16) 42	1(16) 41	1(15) 40	1(16) 35	0(15) 36	0(13) 38	0(13) 36	1(16) 36	0(16) 31
	III	1(14) 27	1(14) 30	1(12) 39	1(14) 39	0(14) 26	0(14) 27	0(12) 33	0(12) 29	0(14) 31	0(14) 31
	IV	0(19) 19	0(19) 19	0(16) 19	0(17) 20	0(18) 17	0(18) 15	0(17) 15	0(17) 18	0(18) 15	0(18) 16

\* Brachial indices and counts in the left column are for the right of the specimens and those in the right column for the left.

(ca. 180 to 220 versus 120). The number of arm hooks is larger in the present new species (mainly 10 to 18 versus 5 to 13).

All of other five *Abralia* species known from the Indian Ocean are separable from the present new species by having two types of subocular photophores, and DDVD-type of buccal connectives.

The Red Sea species, *Enigmoteuthis dubia* (ADAM, 1960) is a medium-sized species characterized by fasciolate photophore arrangement on the mantle and head, more than nine subocular photophores, uniserial hooks on the club, thick and pale buccal membrane with DDDD-type of buccal connectives (ADAM, 1973). It has very similar photophore arrangement to the present new species, but ADAM's species is easily separable by larger number of hooks on the hectocotylized arm (32 versus 10) and possession of extremely large club hooks.

*E. dubia* was first described as a species of the genus *Enoploteuthis*. Later, ADAM (1973) established the new genus, *Enigmoteuthis* for this species based on the number of subocular photophores and the DDDD-type buccal connectives.

The present new species is close to the subgenus *Pygmabralia* NESIS, 1987 by having the monotypic subocular photophores, and hectocotylization of the right Arm IV (TSUCHIYA & OKUTANI, 1988), while, *A. fasciolata* never fits to NESIS's subgenus by possession of the DDDD-type buccal connectives and devoid of a thick ammoniacal epidermis. The buccal connectives attach to the middle of the Arm III.

As the result of critical observation on the present materials in view of generic and subgeneric characters of *Enigmoteuthis* and *Abralia*, I am inclined to take *Enigmoteuthis* being an infrageneric taxon among the genus *Abralia*.

NESIS and NIKITINA (1987) established the subgenus *Arabralia* typified by *A. marisarabica*, but it is now considered to be a synonym of *Pygmabralia* NESIS, 1987 (TSUCHIYA & OKUTANI, 1988). *Arabralia* sensu NESIS & NIKITINA (1987) including only a species, *A. marisarabica*, and part of *Pygmabralia* sensu TSUCHIYA & OKUTANI (1988) will be again synonymized with the *Enigmoteuthis* ADAM, 1973.

The subgenus *Enigmoteuthis* is thus characterized by more than five monotypic subocular photophores, two rows of distal arm suckers, hectocotylization in the right Arm IV with a bilobate large and a lunate small crests, and DDDD-type of buccal connectives.

The systematic positions of the present new species is:

Genus *Abralia* GRAY, 1849

Subgenus *Enigmoteuthis* ADAM, 1973

Synonymy: *Enoploteuthis*: ADAM, 1960 non D'ORBIGNY, 1848

*Arabralia* NESIS in NESIS & NIKITINA, 1988

*Pygmabralia*: TSUCHIYA & OKUTANI, 1989 (pars.)

Type species: *Enoploteuthis dubia* ADAM, 1960

Included species:

*Abralia dubia* (ADAM, 1960) n. comb.

*Abralia marisarabica* OKUTANI, 1983

*Abralia fasciolata* n. sp.

### References

- ADAM, W., 1960. Cephalopoda from the Gulf of Aqaba. *Bull. Sea Fish. Res. Stn., State Isr.*, (26): 1-27.
- 1973. Cephalopoda from the Red Sea. *Contr. Knowl. Red Sea*, (47): 9-47.
- NESIS, K. N., 1986. Cephalopods from the seamounts of the Western Indian Ocean. *Okeanologia*, **26**: 123-130. (In Russian with English abstract.)
- , 1982/1987. Abridged key to the cephalopod mollusks of the World Ocean. 355+ii pp. Moscow, Light & Food Industry Publishing House. (In Russian.). Translated into English by B.S. Levitov, ed. by L.A. Burgess (1987), *Cephalopods of the World*. 351 pp. New Jersey, T. F. H. Publication Inc.
- & I. V. NIKITINA, 1987. Redescription of *Abralia steindachneri* and revision of the subgenus system of the genus *Abralia* (Cephalopoda, Enoploteuthidae). *Zool. Zh.*, **66**: 1693-1705. (In Russian with English abstract.)
- OKUTANI, T., 1983. *Abralia marisarabica*, a new enoploteuthid squid from the Arabian Sea (Cephalopoda: Oegopsida). *Bull. natn. Sci. Mus., Tokyo*, (A), **9**: 161-168.
- & S. TSUKADA, 1988. Squids eaten by lancetfish and tunas in the tropical Indo-Pacific Oceans. *J. Tokyo Univ. Fish.*, **75**: 1-44, pls. 1-7.
- ROPER, C. F. E., & G. L. VOSS, 1983. Guidelines for taxonomic descriptions of cephalopod species. *Mem. natn. Mus. Victoria*, (44): 49-63.
- SILAS, E. G., 1968. Cephalopoda of the west coast of India collected during the cruises of the research vessel *VARUNA*, with a catalogue of the species known from the Indian Ocean. *Proc. Symp. Mollusca*, **1**: 277-359.
- , R. SARVESAN & M. M. MEIYAPPAN, 1985. Oceanic squids. Cephalopod bionomics, fisheries and resources of the exclusive economic zone of India, 12. *CMFRI Bull.*, (37): 140-145.
- TSUCHIYA, K., & T. OKUTANI, 1988. Subgenera of *Enoploteuthis*, *Abralia* and *Abraliopsis* of the squid family Enoploteuthidae (Cephalopoda, Oegopsida). *Bull. natn. Sci. Mus., Tokyo*, (A), **14**: 119-136.